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OWASCO LAKE, CAYUGA COUNTY, NEW YORK

Pacific Northwest Environmental
Research Laboratory

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16. ABSTRACT
Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivded according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
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REPORT

ON

OWASCO LAKE

CAYUGA COUNTY

NEW YORK

EPA REGION II

WORKING PAPER No. 163

WITH THE COOPERATION OF THE

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

AND THE

NEW YORK NATIONAL GUARD

DECEMBER, 1974

CONTENTS

	Page
Foreword	ii
List of New York Study Lakes	iv
Lake and Drainage Area Map	v
Sections	
I. Introduction	1
II. Conclusions	1
III. Lake and Drainage Basin Characteristics	3
IV. Lake Water Quality Summary	4
V. Literature Reviewed	9
VI. Appendices	10

FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS*

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

* The lake discussed in this report was included in the National Eutrophication Survey as a lake of special interest to the New York Department of Environmental Conservation. For this reason, tributaries and nutrient sources were not sampled and this report relates only to data obtained from lake sampling.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the New York State Department of Environmental Conservation for professional involvement and to the New York National Guard for conducting the tributary sampling phase of the Survey.

Henry L. Diamond, Commissioner of the New York Department of Environmental Conservation, and Leo J. Hetling, Director, and Italo G. Carcich, Senior Sanitary Engineer, Environmental Quality Research, Department of Environmental Conservation, provided invaluable lake documentation and counsel during the Survey.

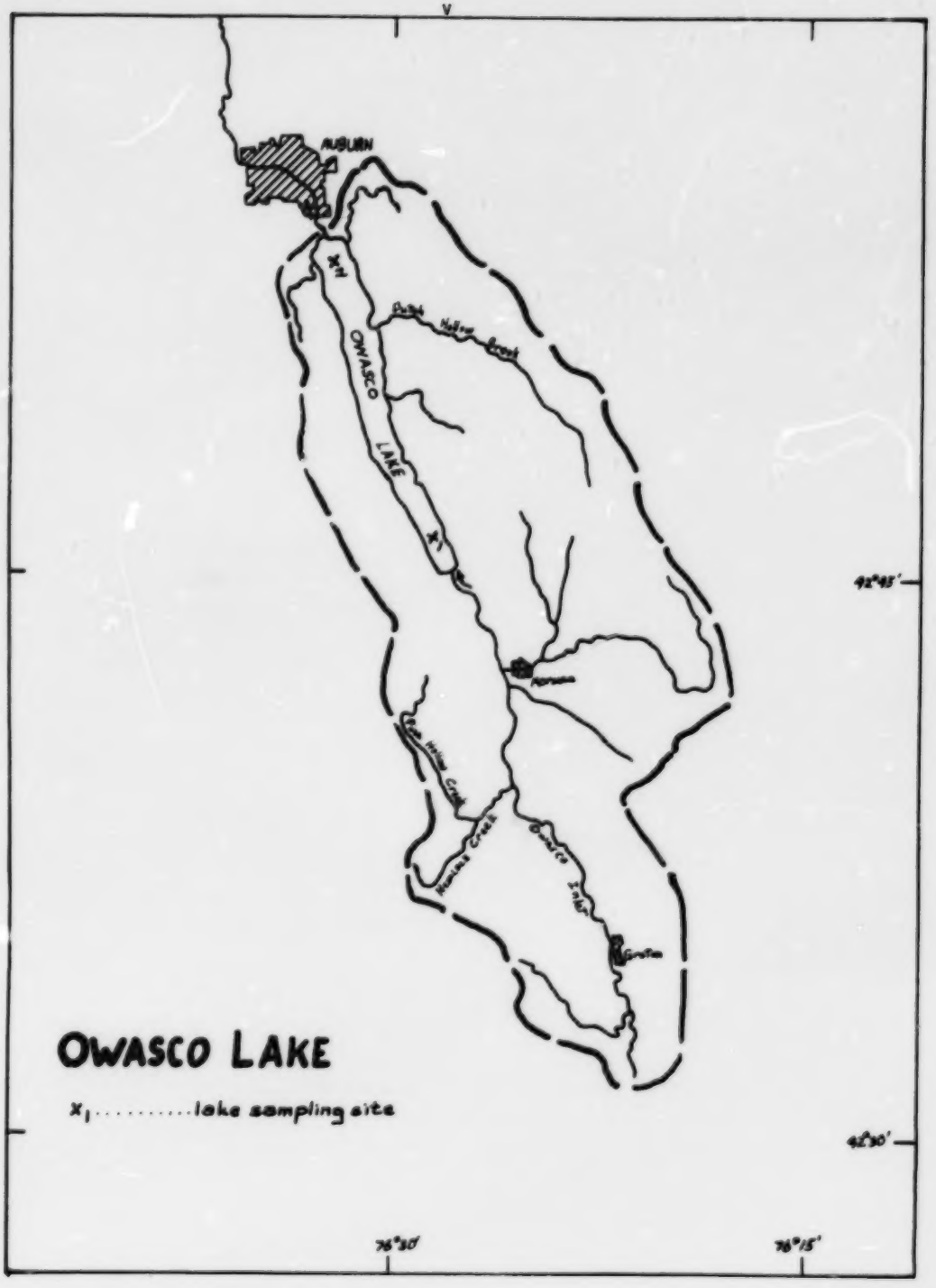
Major General John C. Baker, the Adjutant General of New York, and Project Officer Lieutenant Colonel Fred Peters, who directed the volunteer efforts of the New York National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF NEW YORK

LAKE NAME	COUNTY
Allegheny Reservoir	Cattaraugas, NY; McLean, Warren, PA
Black	St. Lawrence
Canadaigua	Ontario
Cannonsville	Delaware
Carry Falls	St. Lawrence
Cassadaga	Chautauqua
Cayuga	Seneca, Tompkins
Champlain	Clinton, Essex, NY; Addison, Chittenden, Franklin, VT
Chautauqua	Chautauqua
Conesus	Livingston
Cross	Cayuga, Onondaga
Goodyear	Otsego
Huntington	Sullivan
Keuka	Ontario
Long	Hamilton
Lower St. Regis	Franklin
Otter	Cayuga
Owasco	Cayuga
Raquette Pond	Franklin
Round	Saratoga
Sacandaga Res.	Fulton, Saratoga
Saratoga	Saratoga
Schroon	Essex, Warren
Seneca	Seneca, Schyler, Yates
Swan	Sullivan
Swinging Bridge Res.	Sullivan



OWASCO LAKE

x_1 ..... lake sampling site

OWASCO LAKE

STORET NO. 3627

I. INTRODUCTION

Owasco Lake was included in the National Eutrophication Survey as a lake of special interest to the New York State Department of Environmental Conservation. For this reason, tributaries and nutrient sources were not sampled, and this report relates only to data obtained from lake sampling.

II. CONCLUSIONS

A. Trophic Condition:

Survey data show that Owasco Lake is mesotrophic. Of the 26 New York lakes sampled in the fall of 1972, when all essentially were well-mixed, one had less mean total phosphorus, four had less mean dissolved phosphorus, and 25 had less mean inorganic nitrogen. Inorganic nitrogen values were high compared to phosphorus levels but this has been observed in other Survey lakes with low levels of phosphorus. For all New York data, ten of the lakes had less mean chlorophyll a, and nine had greater Secchi disc transparency.

Survey limnologists noted that the water was very clear on all sampling dates, and no algal blooms were observed.

Reportedly, Owasco Lake appears to be undergoing fairly rapid eutrophication (Ketelle and Uttormark, 1971).

B. Rate-Limiting Nutrient:

The algal assay results show that Owasco Lake was phosphorus limited at the time the sample was collected. Lake data show that phosphorus was limiting at the other sampling times as well (N/P ratios were greater than 143/1, and phosphorus limitation would be expected).

III. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry*:

1. Surface area: 6,592 acres.
2. Mean depth: 96 feet.
3. Maximum depth: 177 feet.
4. Volume: 633,104 acre/feet.

B. Precipitation:

1. Year of sampling: 52.8 inches.
2. Mean annual: 37.6 inches.

* Birge and Juday, 1914.

IV. LAKE WATER QUALITY SUMMARY

Owasco Lake was sampled three times during the open-water season of 1972 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from two stations on the lake and from a number of depths at each station (see map, page v). During each visit, a single depth-integrated 15 feet to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the last visit, a single five-gallon depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected for chlorophyll a analysis. The maximum depths sampled were 144 feet at station 1 and 45 feet at station 2.

The results obtained are presented in full in Appendix B, and the data for the fall sampling period, when the lake was essentially well-mixed, are summarized below. Note, however, the Secchi disc summary is based on all values.

For differences in the various parameters at the other sampling times, refer to Appendix B.

A. Physical and chemical characteristics:

Parameter	Minimum	Mean	Median	Maximum
		FALL VALUES (10/12/72)		
Temperature (Cent.)	5.8	12.2	13.5	14.0
Dissolved oxygen (mg/l)	8.2	9.1	9.2	9.4
Conductivity (μmhos)	260	266	260	280
pH (units)	7.8	8.1	8.2	8.3
Alkalinity (mg/l)	100	105	105	109
Total P (mg/l)	0.007	0.008	0.008	0.010
Dissolved P (mg/l)	0.005	0.005	0.005	0.007
NO_2 + NO_3 (mg/l)	0.100	0.820	0.900	1.080
Ammonia (mg/l)	0.020	0.024	0.020	0.050
		ALL VALUES		
Secchi disc (inches)	90	106	108	126

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Number per ml
05/28/72	1. Dinobryon	585
	2. Rhaphidiopsis	386
	3. Polycystis	253
	4. Cyclotella	120
	5. Navicula	42
	Other genera	145
	Total	1,531
07/24/72	1. Fragilaria	548
	2. Dinobryon	530
	3. Flagellates	277
	4. Rhaphidiopsis	60
	5. Synedra	48
	Other genera	164
	Total	1,627
10/12/72	1. Fragilaria	743
	2. Melosira	502
	3. Dinobryon	402
	4. Flagellates	231
	5. Polycystis	110
	Other genera	663
	Total	2,651

2. Chlorophyll a -
(Because of instrumentation problems during the 1972 sampling, the following values may be in error by plus or minus 20 percent.)

Sampling Date	Station Number	Chlorophyll a (µg/l)
05/28/72	01	7.2
	02	29.3
07/24/72	01	4.6
	02	2.6
10/12/72	01	4.5
	02	3.0

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.005	1.026	0.2
0.010 P	0.015	1.026	1.4
0.020 P	0.025	1.026	5.5
0.050 P	0.055	1.026	17.1
0.050 P + 5.0 N	0.055	6.026	11.6
0.050 P + 10.0 N	0.055	11.026	12.6
10.0 N	0.005	11.026	0.1

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Owasco Lake was low at the time the assay sample was collected. Increasing yields with increasing levels of phosphorus, and the lack of increase in yield with the addition

of only nitrogen, indicate that the lake was phosphorus limited at the time the sample was collected. Lake data at that time, as well as the other sampling times, indicate that Owasco Lake is phosphorus limited (N/P ratios were above 143/1).

V. LITERATURE REVIEWED

Birge, Edward A., and Chancey Juday, 1914. A limnological study of the Finger Lakes of New York. Bull. 32, U.S. Bur. Fish.

Ketelle, Martha J., and Paul D. Uttormark, 1971. Problem lakes of the United States. EPA Water Poll. Contr. Res. Ser., Proj. #16010 EHR.

APPENDIX A

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 74/11/26

342701
42 46 50.0 076 28 56.0
OWASCO LAKE
36 NEW YORK

11EPALES
3

2111202
0030 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/05/28	10 39	0000	11.7	12.6	90	315	8.20	115	0.900	0.060	0.009	0.006
	10 39	0010	10.2	12.3		315	8.20	110	0.900	0.090	0.013	0.004
	10 39	0030	8.1	12.5		310	8.10	114	0.940	0.040	0.011	0.007
72/07/24	14 40	0000			126	290	8.70	114	0.900	0.050	0.012	0.006
	14 40	0004	24.8	8.8		290	8.70	115	0.900	0.040	0.012	0.005
	14 40	0015	24.5			290	8.50	114	0.900	0.040	0.013	0.006
	14 40	0050	11.9	9.0		280	8.10	111	1.060	0.040	0.009	0.009
	14 40	0125	5.2	10.0		270	8.50	115	1.020	0.050	0.019	0.009
72/10/12	09 35	0000				260	8.25	108	0.910	0.020	0.009	0.005
	09 35	0004	13.8	9.4		260	8.25	106	0.910	0.030	0.008	0.005
	09 35	0015	13.6	9.4		260	8.25	107	0.920	0.030	0.007	0.005
	09 35	0025	13.5	9.4		260	8.30	109	0.900	0.020	0.007	0.005
	09 35	0035	13.5	9.2		260	8.35	108	0.910	0.020	0.008	0.005
	09 35	0045	13.5	9.2		270	8.35	105	0.910	0.020	0.007	0.005
	09 35	0060	13.4	9.2		270	8.35	104	0.910	0.020	0.008	0.005
	09 35	0080	10.6	8.6		270	8.00	106	0.980	0.020	0.007	0.005
	09 35	0100	8.0	8.6		275	7.90	105	1.080	0.030	0.008	0.005
	09 35	0120	7.0	8.6		280	7.85	105	0.100	0.020	0.007	0.006
	09 35	0144	5.8	8.2		280	7.85	104	0.100	0.020	0.010	0.007

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/05/28	10 39	0000	7.2J
72/07/24	14 40	0000	4.6J
72/10/12	09 35	0000	4.5J

J VALUE KNOWN TO BE IN ERROR

STORET RETRIEVAL DATE 74/11/26

362702
42 53 40.0 076 32 13.0
OWASCO LAKE
36 NEW YORK

11EPALES
3

2111202
0030 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/05/28	11 17	0000	14.5	11.7	90	315	8.30	116	0.940	0.020	0.012	0.006
	11 17	0010	13.8	11.8		310	8.30	114	0.900	0.030	0.013	0.003
	11 17	0020	13.7	11.8		315	8.30	114	0.900	0.050	0.011	0.003
72/07/24	14 00	0000			118	280	8.50	112	0.900	0.020	0.012	0.010
	14 00	0004	23.0	9.0		280	8.50	112	0.920	0.050	0.014	0.006
	14 00	0015	20.5	7.6		280	8.00	107	0.970	0.060	0.013	0.006
	14 00	0030	14.4	8.2		290	8.00	105	1.060	0.040	0.011	0.006
	14 00	0045	11.0	9.0		290	8.00	107	1.010	0.040	0.015	0.006
72/10/12	09 05	0000			108	275	7.90	103	0.890	0.020	0.009	0.006
	09 05	0004	14.0	9.3		260	8.00	100	0.890	0.020	0.008	0.005
	09 05	0015	14.0	9.4		260	8.10	101	0.890	0.030	0.008	0.005
	09 05	0022	13.8	9.4		260	8.20	106	0.880	0.020	0.008	0.005
	09 05	0031	13.9	9.2		260	8.20	102	0.890	0.050	0.008	0.005
	09 05	0040	14.0	9.2		260	8.25	100	0.880	0.020	0.009	0.006

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/05/28	11 17	0000	29.3J
72/07/24	14 00	0000	2.6J
72/10/12	09 05	0000	3.0J

J VALUE KNOWN TO BE IN ERROR